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In re Application of:)

Samuel C. Weaver)

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Patent Examiner: Nguyen, Son T.)

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METAL MATRIX
COMPOSITE HORSESHOE

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RESPONSE TO OFFICIAL ACTION

In the Official Action dated February 24, 2003, Claims 1-16 were rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,344,608 to Eom et al. (herein "Eom") in combination with U.S. Patent No. 5,573,607 to Weaver (which was cited and specifically incorporated by reference in the above-captioned application) (herein "the '607 Patent").

In response to the Official Action, the Applicant references the previously submitted Declaration of the inventor, Samuel C. Weaver, which further evidences the patentability of the claimed invention. (cited herein as "Weaver Decl. ¶_.") The Applicant respectfully submits that Claims 1-16 as presently amended are patentable for the reasons that are further explained herein.

The invention of the subject application is directed to an improvement in horseshoes, namely – a horseshoe made of metal composite material. The presently disclosed invention is distinguished from horseshoes that are made of metals and metal alloys. As a horseshoe made of metal matrix composite, the disclosed invention is distinguished from metal alloys and addresses a long-felt need in the prior art for an improved horseshoe that overcomes shortcomings of horseshoes that are known in the prior art. For example, Japanese Patent No. 407076749A and Eom, the primary reference in the Official Action, identified as early as 1993 the need for horseshoes that are lighter and that have shock absorption capability. However, such prior horseshoes attempted to address that need with a horseshoe composed of a ductile material. Such horseshoes tend to loose their shape as compared to the metal matrix composite horseshoe of the present invention, which affords both improved vibration damping and stiffness.

“Metal Matrix Composites” are not “Metal Alloys”

There are significant differences between metals and metal matrix composites and also between metal alloys and metal matrix composites. Metal matrix composites are a different class of materials than metals and metal alloys. A metal matrix composite is not an interchangeable substitute for a metal alloy. Metal alloys have one or more metallic and/or non-metallic alloying elements that combine with a base or parent metal at the atomic level. In some cases, the alloying elements replace atoms in the parent metal's lattice. In other cases, the alloying elements are included in the parent metal's lattice without occupying the parent

metal's lattice sites. (see e.g. The Fabricator.com, "The structure of metal", Bob Capudean, April 24, 2003.)

A "metal matrix composite" is not another name for a metal alloy. It is a different class of material. A metal matrix composite is also made of two or more types of material, but in a metal matrix composite, the materials do not combine at the atomic level. In the metal matrix composite, one of the materials (called a reinforcing constituent) is added to a host metal. In some cases, the reinforcing constituent is in the form of a fiber while in other cases, the reinforcing constituent is in the form of a particle. The reinforcing constituent changes the properties of the host metal in ways that are not always predictable and that are not generally possible through conventional alloying methods. (see An Introduction to Metal Matrix Composites, pp. 1-70, Clyne and Withers, Cambridge University Press 1993.)

Need for Improved Horseshoe

The use of a metal or metal alloy in a particular application does not necessarily mean that a metal matrix composite would work in the same or a similar application. For example, it has been known in the prior art that metal alloy horseshoes are relatively lightweight in comparison to traditional ferrous metal horseshoes. It also has been known that some metal alloy horseshoes are ductile so as to provide cushioning to the hoof. (see, e.g. Eom) However, horseshoes that afforded cushioning because they were ductile also tended to lose their shape. Therefore, there was a need in the prior art for a horseshoe that was not only

lightweight, but that also provided a higher degree of stiffness so that the horseshoe would better retain its shape while still cushioning the hoof.

The Presently Disclosed Invention

The presently disclosed invention is a horseshoe that provides both improved stiffness and cushioning as further described in the subject application. The horseshoe is made of a metal matrix composite material that affords cushioning to the horse, but that also retains its shape.

More specifically, the subject application discloses a metal matrix composite horseshoe that is preferred because it is lightweight and has high stiffness while it also affords cushioning for the hoof. The cushioning is due to relatively high vibration damping in the metal matrix composite. (Weaver Decl. ¶ 7.) High vibration damping is not a property that is common to all metal matrix composites. (Weaver ¶¶ 9, 15 and 16.) Without specific testing of a metal matrix composite, there is no way to reliably predict the degree of vibration damping for the metal matrix composite. (Weaver ¶¶ 14, 15 and 16.) As a result of testing, it was discovered that high vibration damping is a property of the metal matrix composite that is disclosed in the subject application. (Weaver ¶¶ 15 and 17.)

The metal matrix composite of the horseshoe disclosed in the application is comprised of (1) a metal selected from the group consisting of aluminum, magnesium, titanium, and mixtures thereof; and (2) particles of silicon tetraboride or silicon hexaboride. The specific gravities of silicon tetraboride and silicon hexaboride are similar to the specific gravity of aluminum. One important consequence of that similarity is that when the silicon tetraboride or silicon

hexaboride particles are mixed with molten aluminum, magnesium or titanium, the silicon tetraboride or silicon hexaboride particles remain homogeneously suspended with a limited degree of agitation of the melt. This tends to lower oxide inclusions in the mixture and improve the purity of the metal matrix composite.

Patentability of the Claimed Invention over the Cited References

Claim 1 is patentable over U.S. Patent 5,344,608 to Eom et al. (herein "Eom") in that, among other reasons, Claim 1 requires:

"A metal matrix composite horseshoe having improved vibration damping and stiffness, said horseshoe comprising a metal matrix composite that is formed from a molten metal selected from the group consisting of aluminum, magnesium, titanium and mixtures thereof..."

There is nothing in Eom that even describes or suggests a metal matrix composite, much less a metal matrix composite that is used in a horseshoe. Nothing in Eom would lead one skilled in the art to produce a horseshoe with improved vibration damping and stiffness as required by Claim 1.

The Applicant cited Eom in the Prior Art Disclosure Statement. Eom teaches the use of an aluminum alloy horseshoe that includes specified amounts of aluminum, silicon, iron, copper, manganese, magnesium, chromium and zinc. (see e.g. Eom: Col. 1, lines 56-61; Col. 2, lines 7-63) However, Eom fails to suggest the use of any metal matrix composite horseshoe. Eom discloses a horseshoe that is composed of an aluminum alloy, not a metal matrix composite. Moreover, Eom fails

to suggest any horseshoe of any material that has properties of both stiffness and vibration damping. On the contrary, Eom actually teaches away from the use of a material having a property of stiffness! Eom teaches the use of an aluminum alloy having ductility such that it can be more readily fitted to the horse. (Col. 1, lines 7-10, 25-32, 48-51, Col. 3, lines 7-9; and Weaver Decl. ¶ 8.) High vibration damping as required by the claims is not even a property that is common or expected in aluminum alloys such as described in Eom. (see Weaver Decl. ¶ 8.)

The patentable differences of Claim 1 are not somehow made unpatentable by any proper combination of Eom with the '607 Patent. The '607 Patent has no mention that the metal matrix composite affords "vibration damping" in combination with "stiffness". (Weaver Decl. ¶¶ 9 and 14) According to the inventor of the '607 Patent, the disclosure of the '607 Patent would not have caused one skilled in the art to consider the metal matrix composite disclosed therein to be considered as useful in making an improved horseshoe for which those properties are desired. (Weaver Decl. ¶ 9, 11, 14, 15, 16, 18 and 19.) At the time that the '607 Patent issued, the high vibration damping property of the metal matrix composite was unknown and unexpected. (Weaver Decl. ¶¶ 14, 15 and 16.) The high vibration damping property of the metal matrix composite was learned from testing of that material years after the '607 Patent was issued. (Weaver ¶¶ 14 – 19.)

Specifically, the '607 Patent states that aluminum and magnesium are used in a "wide variety of industries" and that titanium is used to a lesser extent. (Column 1, lines 19-22.) The '607 Patent teaches that the usefulness of aluminum, magnesium and titanium is limited due to "drawbacks" - including low stiffness,

high thermal coefficient of expansion, and low strength. (Column 1, lines 22-25.)

The '607 Patent also teaches that "some of the drawbacks have been overcome through the use of metal matrix composites of those metals." (Column 1, lines 26-27.) However, there is no teaching in the '607 Patent that metal matrix composites can be substituted indiscriminately wherever aluminum, magnesium or titanium are used or that the particular metal matrix composite therein described somehow would provide an improved horseshoe. (Weaver Decl. ¶ 9.)

Nothing in Eom or the '607 Patent, either alone or in combination, teaches that the improved metal matrix composite horseshoe of Claim 1 provides both improved vibration damping and stiffness. (Weaver Decl. ¶ 9.) There is no suggestion in Eom of a horseshoe made of a metal matrix composite. Instead, the horseshoe in Eom is made of a metal alloy. Attempting to combine Eom with the '607 Patent does not lead to a different result. The '607 Patent nowhere describes that the metal matrix composite therein described somehow should be substituted for the aluminum alloy of Eom or that even if the substitution were made, a horseshoe having both stiffness and vibration damping would result. (Weaver Decl. ¶ 14.)

To support a theory that the claimed invention is unpatentable, the Official Action contends that Eom can be properly combined with the '607 Patent. To do this, the Official Action first ignores all differences between metal alloys and metal matrix composites and asserts that it is known from Eom that horseshoes are comprised of a metal matrix composite. This is clear error. Eom only describes the use of an aluminum alloy. Eom says nothing about a metal matrix composite.

Conceding the Eom says nothing about “particles of silicon boride”, the Official Action compounds this error and further argues that it is known from the '607 Patent that metal matrix composites are substituted for aluminum metal and that, somehow, it would have been obvious to one skilled in the art to substitute the silicon boride of the '607 Patent into the aluminum alloy of Eom.

Such a rejection theory does not make Claim 1 unpatentable. Claim 1 as presently amended is directed to a particular metal matrix composite and neither Eom nor the '607 Patent, either alone or in combination, show that the particular metal matrix composite of Claim 1 has ever been used in horseshoes having both improved vibration damping and stiffness properties. (Weaver Decl. ¶¶ 8, 9, 10, 15, 16 and 17.) What may have been within the knowledge of one skilled in the art is insufficient absent evidence that one of ordinary skill in the art actually possessed such knowledge. Smiths Indus. Med. Sys., Inc., 183 F.3d 1347, 1356 (Fed. Cir. 1999). Neither Eom nor the '607 Patent, either alone or in combination, evidence any known suitability of the specified metal matrix composite as having properties of both stiffness and vibration damping. (Weaver Decl. ¶¶ 12, 14, and 15.) Consequently, nothing in those references describes or suggests that one attempting to construct a horseshoe having both stiffness and vibration damping had merely to select silicon hexaboride for use in a known horseshoe composed of a metal matrix composite. (Weaver Decl. ¶¶ 12, 16, 18, 19 and 20.) In fact, neither Eom nor the '607 Patent suggest the use of a metal matrix composite in horseshoes and neither Eom nor the '607 Patent suggest that the metal matrix composite of Claim 1 has properties of both stiffness and vibration damping. (Weaver Decl. ¶¶ 8, 14, 15, 16

and 17.) Therefore, no basis for contending that one skilled in the art could refer to Eom and the '607 Patent to use a metal matrix composite to construct a horseshoe or that using silicon boride in such a metal matrix composite would afford properties of both stiffness and vibration damping in the horseshoe as required by Claim 1. (Weaver Decl. ¶¶ 19 and 20.)

The Official Action engages an impermissible "obvious to try" standard for which the cited references, either alone or in combination, fail to teach all the limitations required by Claim 1. The theory on which the Official Action attempts to combine Eom and the '607 Patent suffers from a two-fold difficulty. First, Eom is directed to the use of aluminum alloys and makes no mention of the use of metal matrix composites of any kind in horseshoes. Second, the '607 Patent does not teach that metal matrix composites are substitutes for aluminum alloys. (Weaver Decl. ¶¶ 9 and 13.) The '607 Patent states that metal matrix composites have been substituted to overcome the drawbacks of metals, (Column 1, lines 26-27.) but there is no teaching in the '607 Patent that metal matrix composites similarly can be substituted for metal alloys. (Weaver Decl. ¶ 11.) Indeed, there would be no obvious motivation to substitute the metal matrix composite of the '607 Patent for the metal alloy of Eom when that metal alloy itself is intended to modify selected properties of the base aluminum metal.

Even assuming that Eom could be said to properly suggest the use of metal matrix composite in horseshoes (which it does not), nothing in Eom suggests that the aluminum alloy horseshoe therein described or the metal matrix composite of the '607 Patent would have both improved stiffness and improved cushioning due to

vibration damping. (Weaver Decl. ¶¶ 8, 14 and 15.) On the contrary, the horseshoe that is described in Eom is said to achieve shock absorption because the aluminum alloy therein described is relatively ductile. In contrast, the metal matrix composite horseshoe of Claim 1 reduces shock through vibration damping while also exhibiting stiffness that tends to better retain the shape of the horseshoe. (Weaver Decl. ¶¶ 15 and 16.) There is nothing in Eom to suggest a horseshoe that is comprised of a metal matrix composite or any other material that affords both stiffness and cushioning by vibration damping in accordance with the subject invention. (Weaver Decl. ¶ 8.)

Indeed, Eom actually teaches away from the use of a metal matrix composite to make horseshoes! Following the teachings of Eom, one normally skilled in the art would be led to use an aluminum alloy as opposed to the metal matrix composite as required by Claim 1. (Weaver Decl. ¶¶ 8, 9, 10 and 11.) A reference does not contain a suggestion to combine references and teaches away from the invention if one of ordinary skill in the art following the line of development disclosed in the reference would not likely produce the Applicant's result. Tec Air, Inc. v. Denso Mfg. Michigan, Inc., 192 F.3d 1353, 1360 (Fed. Cir. 1999). Ecolochem, Inc. v. Southern California Edison Co., 227 F.3d 1361 (Fed. Cir. 2000), reh'g denied, in banc suggestion declined, (December 13, 2000) and cert. denied, 121 S. Ct. 1607 (2001). (Secondary reference recommended alternative method to that of primary references.) The '607 Patent teaches the use of a metal matrix composite in place of selected metals, not metal alloys. (Weaver Decl. ¶¶ 9 and 11.) The horseshoes in Eom are made from an aluminum alloy, which is different than aluminum metal.

(Eom Col. 1, lines 33-52; Col 2, lines 7-63; and Weaver Decl. ¶ 10.) Eom teaches that aluminum is not preferred and that aluminum alloy is to be used. (Col. 1, lines 4-10 and 33-48.) Using an aluminum alloy in the manufacture of horseshoes as taught by Eom would not lead one skilled in the relevant art to use a substitute for aluminum, namely a metal matrix composite as taught by the '607 Patent. (Weaver Decl. ¶¶ 18 and 19) Since Eom teaches against the use of metals, Eom also would teach away from the use of metal alternatives - in this case, a metal matrix composite. Therefore, a combination of references as proposed by the Official Action would be against teachings of Eom and the '607 Patent.

The combination of the '607 Patent and Eom as proposed by the Official Action is necessarily based on the Applicant's own teachings and not the teachings of the references. Claim 1 is not made unpatentable by combining Eom and the '607 Patent in accordance with the Applicant's own teachings. A determination of obviousness must involve more than indiscriminately combining prior art. *Micro Chem., Inc. v. Great Plains Chem. Co., Inc.*, 103 F.3d 1538, 1546 (Fed. Cir. 1997), cert. denied, 117 S. Ct. 2516 (1997). The Patent Office must show a motivation to combine references to prevent the use of the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. *In re Rouffet*, 149 F. 3d 1350 (Fed. Cir. 1998)(reversing the Patent Office Board of Appeals holding of obviousness). The requirement of a motivation to combine references is necessary to prevent findings of obviousness based improperly on "the subtle but powerful attraction" of hindsight reconstruction. *Ruiz v. A.B. Chance Co.*, 234 F. 3d 654, 664-65 (Fed. Cir. 2000).

Absent any disclosure or suggestion of an element or step that the cited references have failed to disclose, there can be no motivation to modify the prior art to arrive at the claimed invention. *In re Kotzab*, 217 F. 3d 1365, 1370 (Fed. Cir. 2000)(reversing the Patent Office Board of Appeals and Interferences' affirmance of the Patent Office rejection of an application based on a combination of references). Accordingly, there is no motivation or suggestion to combine Eom and the '607 Patent because neither Eom nor the '607 Patent teach that a metal matrix composite of the '607 Patent can be substituted for the aluminum alloy of Eom. Furthermore, even if such a substitution were to occur, neither reference teaches that the metal matrix composite horseshoe has both stiffness and cushioning due to high vibration damping.

The Official Action concedes that Eom does not teach the use of silicon boride composition. The '607 Patent does not teach that a metal matrix composite having silicon boride will demonstrate properties of both stiffness and cushioning due to high vibration damping. The Official Action's assertion of "ordinary skill in the art" will bridge that gap. Missing suggestions cannot be supplied merely by reference to "ordinary skill in the art." Imbuing one of ordinary skill in the art with the knowledge of the invention at issue in the absence of art that conveys or suggests such knowledge is to fall victim to hindsight reconstruction. Al-Site Corp. v. VSI Int'l, Inc., 174 F.3d 1308 (Fed. Cir. 1999). The best tool in preventing impermissible hindsight reconstruction is the rigorous application of the requirement for a showing of a teaching or motivation to combine prior art references. In re Dembiczak, 175 F.3d 994 (Fed. Cir. 1999) (reversing the Board of Patent Appeals

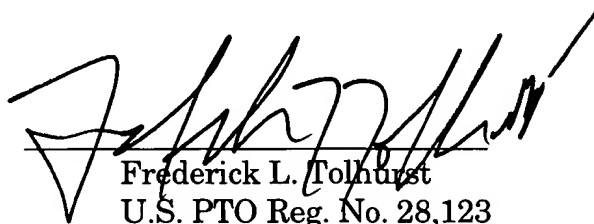
and Interferences affirmation of the Patent Office obviousness rejections). There is no suggestion in Eom or the '607 Patent as to why one skilled in the art would be led by a reference (Eom) that teaches the use of metal alloys in horseshoes to attempt to use a metal matrix composite that is taught in the '607 Patent to be a possible alternative for some uses of metals (not metal alloys). Furthermore, neither reference suggests that the metal matrix composite horseshoe has both stiffness and cushioning due to vibration damping. Claim 1, therefore, is patentable over those references.

Claim 9 is directed to a metal matrix composite horseshoe having "stiffness" and "vibration damping" and specifies "molten aluminum metal" for forming the metal matrix composite. Accordingly, Claim 9 is patentable over Eom and the '607 Patent for the same reasons discussed with respect to Claim 1. Claims 2-8 and 10-16 are dependent on Claims 1 and 9 respectively and incorporate the structure of Claims 1 and 9. Therefore, Claims 2-8 and 10-16 are also patentable over the prior art for the same reasons stated with respect to Claim 1.

In accordance with the foregoing amendments to the claims and in view of the above remarks, Claims 1-16 are considered to be in condition for allowance and such allowance is hereby respectfully requested.

Respectfully submitted,

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